

Serial Number 09/339,036

IN THE ABSTRACT:

Please delete the original abstract in its entirety, and substitute therefor the new abstract of the disclosure presented in Appendix A, attached hereto.

IN THE TITLE:

Please delete the original title and substitute therefore the following new title:

-CAPACITY DETECTING CIRCUIT FOR A BATTERY-.

IN THE DRAWINGS:

Please amend Figs. 2 and 3 to include English language labels and reference numerals, as marked in red on the copies of Figs. 2 and 3, attached hereto for approval by the Examiner.

IN THE CLAIMS:

Please cancel claims 1 and 2, without prejudice or disclaimer, and substitute therefor new claims 3-7, as follows:

1 ~~2~~. (New) A capacity detecting circuit for a battery, comprising:

a voltage detecting circuit, a current detecting circuit, a switching circuit, and a capacity display circuit,

wherein said voltage detecting circuit is connected to said battery and arranged to compare a voltage of said battery with a reference voltage and to signal said driving circuit to cut-off a connection between the battery and a load when the voltage of the battery is lower than the reference voltage,

wherein said current detecting circuit is connected in parallel with said battery and said voltage detecting circuit, and is arranged to compare a detected current with a plurality of current thresholds and thereby classify said detected current into ranges,

wherein said switching circuit includes a switching device and lamps connected to said outputs of said current detecting circuit, said switching circuit being arranged to convert said outputs of said current detecting circuit into current indicating signals indicative of an amount of current being supplied to said driving circuit, to illuminate respective lamps in response to said

current indicating signals, and to cut-off said connection between said battery and said load if said current is excessive, and

wherein said capacity display circuit includes a plurality of comparison circuits having inputs connected to said reference voltage through said resistors, and inputs connected to said switching circuit, said plurality of comparison circuits further having outputs each of which is connected to a respective resistance and lamp, said comparison circuits being thereby arranged to compare a load current-adjusted voltage of said battery with a resistance-adjusted reference voltage, and said comparison circuits thereby outputting signals representative of whether a capacity of said battery is sufficient to support said current being supplied to said driving circuit, and to cut-off said connection between said battery and said load if said capacity is insufficient.

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4. (New) A capacity detecting circuit as claimed in claim 1, wherein said current detecting circuit has four outputs A1 to A4, and is arranged to determine whether a detected current is:

- a. lower than a predetermined first threshold, in which case A1 to A4 are all ^{negative values} "0";
- b. above the predetermined first threshold, in which case A1 is ^{a positive value} "+" and A2-A4 are ^{negative values} "0";
- c. above a predetermined second threshold, in which case A1 and A2 are ^{positive values} "+" and A3 and A4 are ^{negative values} "0";
- d. above a predetermined third threshold, in which case A1 to A3 are ^{a negative value} "+" and A4 is ^{positive values} "0"; and
- e. above a predetermined fourth threshold, in which case A1 to A4 are all ^{positive values} "+";

wherein said switching circuit is connected to said four outputs of said current detecting circuit, said capacity display circuit including three lamps and a multiplexer arranged to convert said four inputs into no-load, light-load, heavy-load, and cut-off signals as follows:

- f. a. if A1 to A4 are all ^{negative values} "0" then a no-load signal is output and said first lamp is lit;
- g. b. if A1 is ^{a positive value} "+" and A2-A4 are ^{negative values} "0" then a light-load signal is output and said second lamp is lit;
- h. c. if A1 and A2 are ^{positive values} "+" and A3 and A4 are ^{negative values} "0" then a heavy load signal is output and said third lamp is lit;

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i.

positive values a negative value

d.

if A1 to A3 are "+" and A4 is "-" then said no-load, light-load, and heavy load signals are all output and said three lamps are all lit; and

j.

If A1 to A4 are all "+" then said current supplied to said driving circuit is cut-off.

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5. (New) A capacity detecting circuit as claimed in claim 1, wherein a number of said comparators, resistors, and lamps in said capacity display circuit is six to thereby indicate six ranges of battery capacity.

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6. (New) A capacity detecting circuit as claimed in claim 1, further comprising a timing circuit connected in parallel with said voltage detecting circuit and said current detecting circuit, said timing circuit being arranged to prevent cut-off of said load current for a predetermined time following detecting that said battery voltage is higher than said reference voltage.

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7. (New) A capacity detecting circuit as claimed in claim 1, wherein the capacity detecting circuit is arranged to be operated manually in order to by-pass said switching circuit and detect whether a capacity of said battery is sufficient to drive the load.

REMARKS

The claims, specification, title, and abstract have been revised to place the application in proper U.S. format. Because the changes are all formal in nature, it is respectfully submitted that the changes do not involve new matter.

The invention is a capacity detecting circuit capable of detecting battery voltage (capacity) and load current, comparing the load current to the battery voltage to determine whether the voltage of the battery is sufficient, displaying both the load current and the relative capacity of the batteries, and cutting off power to the load if the load current is excessive or if the battery voltage is too low in comparison with the load current. Cut-off for low voltage can be delayed by a timer circuit.